

PLANT WATERING AND FEEDING DEVICE

Field of Art

This invention relates to a variable-drip plant watering or feeding device which delivers water or liquid fertilizer solution for the root systems of plants over a period of time. It has particular, but not exclusive, application in agricultural or horticultural industry and in homes, both indoors and outdoors.

Prior Art Background To The Invention

Plants require suitable conditions for growth. Therefore it is necessary to have the right amount of moisture in the soil for the plant to grow well. Very dry or wet soil environments can damage the plant's root system. The prior art includes plant watering devices that can be set to provide a steady amount of water over a period of time which is useful, for example, if the owner is away and cannot water the plant daily. The liquid can be water, or can include water-soluble fertilizer and pesticide.

A problem with known plant watering devices is that the valves, used to control the liquid flow, are complex in design and, as a consequence, difficult to clean. Thus, the liquid passageways in the valves can trap dirt, grit and sludge from fertilizers and other sources. Their complexity also can tend to lead to increased costs in manufacture and maintenance.

United States Patent No. 6,219,963 (Wang) has a valve mechanism that is complex and also convoluted. Grime, dirt and fertilizer residue can build up in the complex passageways of the valve. Moreover, even when the valve is fully opened, the convoluted passageways mean that the liquid still moves through the valve relatively slowly at a rate which is ineffective for cleansing the valve passageways.

United States Patent No. 5,259,142 provides a plant watering device which uses a replaceable filter which acts as a restrictor that limits the liquid flow rate. A disadvantage is that if the user wishes to remove the filter to clean the flow channel of the valve, it is necessary to dismantle or open the device to remove the filter. Furthermore, when the filter is positioned in the flow channel, the flow rate is always restricted by the filter, and it is not possible to change the flow

rate except by removing or replacing the filter, which requires opening the device. To achieve a faster flow rate, the device would have to be dismantled to remove the filter.

United States Patent No. 5,542,605 has a permanently convoluted flow passage which is complex to manufacture, and moreover is difficult to clean unless the device is dismantled or opened.

The discussion of prior art above is not an admission that any of the prior art forms part of the common general knowledge of the skilled addressee.

An object of the invention is to overcome or at least ameliorate one or more of the problems in the prior art, or to at least provide an improved alternative.

A further object of the invention is to provide a plant watering device where the flow rate can be selectively changed without the need to open or dismantle the device.

A preferred object of the invention is to provide a variable-drip watering device that can be altered, without opening or dismantling the device, so as to dispel liquid from the device at a sufficiently high rate as to flush and clean the valve mechanism of the device.

Summary of Invention

According to the present invention, there is provided a variable-drip plant watering device adapted to provide a range of drip rates, including:

- a liquid reservoir;
- a liquid outlet;
- a flow channel connecting the reservoir to the outlet; and
- a valve having a portion of the flow channel passing therethrough so as to regulate liquid flow through said portion;

wherein the valve includes a moveable barrier positionable across the flow channel to selectively restrict flow of liquid through the flow channel to vary the drip rate of the device that waters the plant,

the moveable barrier being moveable between a fully closed position that prevents any liquid flow and one or more opened positions that allow liquid flow at different drip rates.

Preferably, the moveable barrier includes a plurality of apertures any one of which is selectively positionable in one of said opened positions across the portion of the flow channel to restrict liquid flow through whichever of said apertures is selected.

Preferably, one of the plurality of apertures has a cross-section that is larger than the cross-section of said portion of the flow channel which aperture, when aligned with the flow channel, enables unrestricted liquid flow through the valve and the flow channel.

Alternatively, one of the apertures has a cross-section that is substantially the same as the cross-section of said portion of the flow channel which aperture, when aligned with the flow channel, enables substantially unrestricted liquid flow through the valve and the flow channel.

Preferably, the moveable barrier is cylindrical having a cylindrical surface and wherein the plurality of apertures is located on the cylindrical surface of the moveable barrier.

Preferably, the size of each of the apertures increases incrementally around the cylindrical surface of the moveable barrier.

Preferably, the valve also includes an internal cylinder which has at least part of the portion of the flow channel passing through the internal cylinder, and wherein the cylindrical moveable barrier surrounds and rotates around the internal cylinder so that any one of apertures is alignable with the portion of the flow channel to allow liquid flow therethrough.

The portion of the flow channel that is in the internal cylinder may have an elongated cross-section.

Preferably, the cylindrical moveable barrier has an axis of rotation that is aligned substantially perpendicular to the direction of the flow channel.

Preferably, the moveable barrier is connected to an external knob that enables a user to move the moveable barrier to selectively align any one of the plurality of apertures with the portion of the flow channel so as to selectively restrict flow of liquid through the flow channel.

Preferably, the moveable barrier has apertures-less portions which stop liquid flow through the valve when any part of the apertures-less portions are positioned completely across the flow channel.

Preferably, the flow channel, including the portion that passes through the valve, consists of a substantially straight passage.

Preferably, the flow passage is straight and tapered.

Preferably, the liquid reservoir has an inlet through which liquid enters the reservoir, and wherein the inlet is provided with a filter which is distanced from the flow channel.

Preferably, the filter has a mesh with through-holes that are smaller than the cross-section of the flow channel to prevent matter entering the reservoir that would block the flow channel.

Preferably, the outlet is shaped as a spike having a lateral side opening.

Alternatively, the outlet is shaped as a spike having an opening at the end tip of the spike.

Preferably, the reservoir is provided with an elongated enclosure that is open to the liquid in the reservoir, the enclosure having a float therein that indicates the liquid level of the reservoir.

Preferably, the moveable barrier is capable of being completely removed from the portion of the flow channel.

Preferably, the device is provided with one or more supports for supporting the device.

Preferably, the moveable barrier moves across the flow channel in a direction substantially perpendicular to the direction of liquid flow through the flow channel.

Drawings

In order that the invention might be more fully understood, embodiments of the invention will be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a front view of an embodiment of the invention;

Figure 1A is a side view of the embodiment of Figure 1;

Figure 1B is a top view of the embodiment of Figure 1;

Figure 2A is a perspective view (which is slightly exaggerated in perspective) of components of a valve, including an external cylindrical module which surrounds and rotates around an internal cylinder;

Figure 2B is a top view of a lid of the embodiment of Figure 1;

Figure 2C is a perspective view of a spike with an outlet used in the embodiment of Figure 1;

Figure 3 is a cross-sectional view of the embodiment of Figure 1 illustrated with the spike and the legs inserted into soil;

Figure 3A illustrates the valve of Figure 2A shown with the valve completely closed to prevent liquid flow through the valve;

Figures 3B and 3C illustrate the same valve of Figure 2A shown with the valve positioned to provide varying degrees of drip rates from the device; and

Figure 3D illustrates the same valve of Figure 2A shown with the valve completely opened to allow a fast liquid flow rate through the valve to flush the valve clean.

Description of Embodiments

Referring to the drawings, Figure 1 illustrates an embodiment of a variable-drip plant watering device. Figure 1A is a side view of the device of Figure 1.

The device has a liquid reservoir in the form of a canister 10. Liquid in the canister 10 exits through a liquid outlet in the form of spike 14. The canister 10 is connected to the liquid outlet by a flow channel that passes through the body of the spike 14.

A valve 19 is used to regulate the flow of liquid through a portion of the flow channel that passes through the valve 19.

The watering device is also provided with a support in the form of one or more legs 12. In use, the spike 14 and the legs 12 are pushed into the soil.

Liquid from the canister 10 flows through the flow channel. A portion of the flow channel is located in the valve, as best seen in Figure 3. The liquid leaves the apparatus through the spike 14 and is thus able to seep into the soil.

Figure 2A is an exploded perspective view which shows the valve 19 having a moveable barrier in the form of an external cylindrical module 15, which surrounds and rotates around an internal cylinder 16. The arrangement of these components 15, 16 of the valve is seen in the cross sectional view in Figure 3.

In Figure 2A, the external cylindrical module 15 includes a plurality of apertures 18, 20. The apertures 18, 20 are located on the cylindrical surface of the external cylindrical module 15.

In Figure 3, a portion of the flow channel 17, in the form of a passageway, passes through the internal cylinder 16. This passageway 17 of the flow channel connects the canister 10 to the spike 14. Thus, liquid flows from the canister 10, through the passageway 17, into the spike 14 and leaves the device through the liquid outlet in the spike 14.

In Figures 2A and 3, rotation of the external cylindrical module 15 around the internal module 16 enables the plurality of apertures 18, 20 to be selectively moved across the flow channel,

one at a time. At any given orientation, either an aperture-less part or one of the apertures 18, 20 is aligned with and in the passageway 17.

Since the apertures 18, 20 are of varying and differing size, the choice of aperture affects the rate of liquid flow through the passageway 17. Larger apertures allow higher liquid flow rate through the passageway 17, while smaller apertures result in a lower liquid flow rate through the passageway 17.

When each aperture is aligned with the passageway 17, it causes the valve to be in an opened position. Thus, the differences in aperture sizes means that there are a variety and range of opened positions, each allowing a different flow and drip rate. Thus, any one of the apertures can be selectively positioned in one of the opened positions across the portion of the flow channel. This restricts liquid flow through whichever of the apertures is selected.

This ability to vary the flow rate by moving parts of the external cylindrical module 15 in and out of the passageway 17 means that the liquid flow rate can be controlled without an internal filter. Moreover, the fact that flow rate is controlled by moving a barrier in and out of position across a flow channel means that there is the possibility of completely withdrawing the barrier from the passageway to achieve an unimpeded flow rate, which would not be possible in prior art apparatus that rely on filters to impede the flow rate.

The moveable barrier of the external cylindrical module 15 moves across the passageway 17 in a direction substantially perpendicular to the direction of liquid flow through the flow channel, and can be moved completely out of the path of the passageway when required.

In Figure 2A, one of the apertures 20 has a particularly large size. In one embodiment, the cross-section of this large aperture 20 is larger than the cross-section of the passageway 17. This ensures that the large aperture 20 provides unrestricted liquid flow through the passageway 17. In other embodiments, the cross-sectional size of the large aperture 20 is substantially the same as the cross-section of the passageway 17, so that there is substantially unrestricted liquid flow through the valve and the passageway. An advantage of having unrestricted or substantially unrestricted liquid flow is that the faster liquid flow rate enables the valve to be flushed out with fast flowing liquid. This ability to flush out the valve with a faster flow rate means that the valve can be cleaned without the device having to be opened or dismantled.

In the embodiment, to assist in achieving this faster flow rate of liquid, the flow channel is a substantially straight passage, as seen in Figure 3. The flow passage is straight and tapered. It can

be appreciated that if the flow passage were to be convoluted (as found in the prior art), the use of the large aperture 20 might be ineffective in achieving a sufficiently fast flow rate through the valve, since such a convoluted flow passage would slow the liquid flow rate through the valve, and would minimise the effect of having a large aperture 20 in the first place. Hence, in the embodiment, the combination of the large aperture 20, as well as the straight liquid flow passage, together synergize to provide a fast flow rate of liquid through the valves when the largest aperture is selected. This enables the valve to be flushed out to clean the valve of contaminants. The ability of the moveable barrier to be completely removed from the portion of the flow channel, as well as the presence of the straight flow channel, both combine to enable the ability to create the fast fluid flow.

In Figure 2A, the external cylindrical module 15 is connected to an external knob 15A. A user can rotate the knob in order to selectively align any one of the apertures 18, 20 with the passageway 17 in the inner cylinder 16.

In the embodiment, the size of the apertures increases incrementally around the surface of the cylindrical module 15. Hence, rotation of the knob selects a larger or smaller aperture. At the extremes of knob rotation, there is a position where the passageway 17 is completely blocked, while at the other end, there is a position which corresponds to the passageway 17 being completely unrestricted. The user can select the largest aperture by rotating the knob fully counter-clockwise, and can select the closed state by rotating the knob fully clockwise, as seen in Figures 3A to 3D. Figures 3A to 3D illustrate the effect of aligning apertures of different sizes with the passageway 17, and shows the correlation between selected aperture size and fluid drip rate.

In Figure 2A, the knob is provided with icons that indicate the degree of drip rate which are achievable by the various apertures.

The cylindrical surface of the cylindrical module 15 has aperture-less portions which stop liquid flow through the valve when any of these aperture-less portions are positioned completely across the passageway 17.

Figure 3A shows the effect of an aperture-less portion of the cylindrical module 15 being positioned completely across the passageway 17. Liquid flow is completely stopped.

Figure 3B indicates where a small aperture 18 is aligned with the passageway 17, which results in a slow drip rate.

Figure 3C indicates the effect of selecting a slightly larger one of the apertures 18 which results in a slightly faster drip rate.

Figure 3D shows the effect of aligning the largest aperture 20 which enables completely unrestricted liquid flow through the valve. This is useful when the valve must be flushed with a fast current of liquid to remove or dislodge impurities or particles from the valve.

In Figure 2A, the portion of the flow channel, which is in the internal cylinder, has an elongated cross-section.

The external cylindrical module 15 has an axis of rotation. The module 15 rotates about this axis of rotation when the knob 15A is rotated. In Figure 2A, the axis of rotation is aligned substantially perpendicular to the direction of the liquid flow through the passageway 17.

In Figures 1 and 1A, the top of the canister 10 is provided with an inlet through which liquid can be poured into the canister. Thus, there is no need for the device to be removed from the soil, since the canister 10 can be topped up with liquid even when standing in the soil. The canister 10 can also be open to receiving rainwater as a method of topping up with water.

The liquid inlet is provided with a filter which is in the form of a pitted lid 11, shown in Figures 1, 1A and 2B. The mesh of the filter has through-holes that are smaller than the cross-section of the passageway 17. This ensures that the filter will block any particles that are larger than the cross-section passageway 17, which would otherwise block the passageway if such large particles were to reach the passageway.

By having the filter in the lid, the filter is separated and distanced from the flow channel. This ensures that the filter does not slow down the rate of flow through the flow channel when it is desired to have a fast rate of flow. (In the prior art, having the filter in the valve mechanism has the effect of creating a permanently slow rate of fluid flow).

In the embodiment in Figure 2C, the outlet is formed as the spike 14 which has a lateral side opening 21. This ensures that if the lateral side opening 21 becomes clogged with earth, the opening 21 can be cleaned by simply brushing the lateral side opening. Alternatively, in other embodiments, the spike can have an opening at the end tip of the spike (not illustrated).

In Figures 1 and 1A, the canister 10 is provided with an elongated enclosure that is open to the liquid in the canister. The enclosure has a float in the form of a floating ball 13 which is used to indicate the liquid level in the canister.

Embodiments of the variable-drip plant watering device are able to deliver liquid, such as water or fertiliser liquid, directly to the root system of the plant in a controlled manner which can extend over a desired period of time. The rate of delivery can be selected by altering the flow rate of liquid through the valve, as described above.

The components can be made of hard plastic, metal or other suitable waterproof materials.

The size of the components can be varied depending on the amount of liquid that is to be stored in the reservoir. The device may be provided with a range of interchangeable canisters, so that the user can attach canisters of varying size to the same valve 19.

The number of apertures on the external cylindrical module 15 can be varied, increased or decreased, to provide greater or lesser number of options of selectable control.

In this specification, the term "watering device" does not imply that the device is restricted to using water, but can also be used with other liquids that are applied to the root areas of plants. Thus, the term "watering device" is used broadly to signify devices which direct beneficial liquids to the root areas of plants.

In other embodiments (not illustrated) the valve can be modified such that the cylindrical module 15 is caused to rotate within a cylindrical sleeve, thus avoiding the need for the internal cylinder 16.

The embodiments have been described by way of example only, and modifications are possible within the scope of the invention as defined by the appended claims.

The legs are optional, and other embodiments may be supported solely by the spike. Also, the number of legs can vary.

In a further modification, the apertures can be formed or defined by a combination of parts of the external module 15 and the internal cylinder 16. What this means is that, instead of there being self-existent apertures in the surface of the external module 15, there could instead be a single elongated triangular slit that increases in breadth along the circumference of the module 15. This long slit, together with passageway in the internal cylinder 16, together define the aperture. This modification would allow seamless increments of variable drip rates.

The shape of the canister can be modified within the limits of providing a liquid reservoir connectable to the valve.

**CLAIMS:**

1. A variable-drip plant watering device adapted to provide a range of drip rates, including:
a liquid reservoir;
a liquid outlet;
a flow channel connecting the reservoir to the outlet; and
a valve having a portion of the flow channel passing therethrough so as to regulate liquid flow through said portion;
wherein the valve includes a moveable barrier positionable across the flow channel to selectively restrict flow of liquid through the flow channel to vary the drip rate of the device that waters the plant,
the moveable barrier being moveable between a fully closed position that prevents any liquid flow and one or more opened positions that allow liquid flow at different drip rates.
2. A device of claim 1 wherein the moveable barrier includes a plurality of apertures any one of which is selectively positionable in one of said opened positions across the portion of the flow channel to restrict liquid flow through whichever of said apertures is selected.
3. A device of claim 2 wherein one of the plurality of apertures has a cross-section that is larger than the cross-section of said portion of the flow channel which aperture, when aligned with the flow channel, enables unrestricted liquid flow through the valve and the flow channel.
4. A device of claim 2 wherein one of the apertures has a cross-section that is the substantially the same as the cross-section of said portion of the flow channel which aperture, when aligned with the flow channel, enables substantially unrestricted liquid flow through the valve and the flow channel.
5. A device of any one of claims 2 to 4 wherein the moveable barrier is cylindrical having a cylindrical surface and wherein the plurality of apertures is located on the cylindrical surface of the moveable barrier.



6. A device of claim 5 wherein the size of each of the apertures increases incrementally around the cylindrical surface of the moveable barrier.
7. A device of either claim 5 or 6 wherein the valve also includes an internal cylinder which has at least part of the portion of the flow channel passing through the internal cylinder, and wherein the cylindrical moveable barrier surrounds and rotates around the internal cylinder so that any one of apertures is alignable with the portion of the flow channel to allow liquid flow therethrough.
8. A device of claim 7 wherein the portion of the flow channel that is in the internal cylinder has an elongated cross-section.
9. A device of any one of claims 5 to 8 wherein the cylindrical moveable barrier has an axis of rotation that is aligned substantially perpendicular to the direction of the flow channel.
10. A device of any one of claims 2 to 9 wherein the moveable barrier is connected to an external knob that enables a user to move the moveable barrier to selectively align any one of the plurality of apertures with the portion of the flow channel so as to selectively restrict flow of liquid through the flow channel.
11. A device of any one of the preceding claims wherein the moveable barrier has apertures-less portions which stop liquid flow through the valve when any part of the apertures-less portions are positioned completely across the flow channel.
12. A device of any one of the preceding claims wherein the flow channel, including the portion that passes through the valve, consists of a substantially straight passage.
13. A device of claim 12 wherein the flow passage is straight and tapered.



14. A device of any one of the preceding claims wherein the liquid reservoir has an inlet through which liquid enters the reservoir, and wherein the inlet is provided with a filter which is distanced from the flow channel.
15. A device of claim 14 wherein the filter has a mesh with through-holes that are smaller than the cross-section of the flow channel to prevent matter entering the reservoir that would block the flow channel.
16. A device of any one of the preceding claims wherein the outlet is shaped as a spike having a lateral side opening.
17. A device of any one of claims 1 to 15 wherein the outlet is shaped as a spike having an opening at the end tip of the spike.
18. A device of any one of the preceding claims wherein the reservoir is provided with an elongated enclosure that is open to the liquid in the reservoir, the enclosure having a float therein that indicates the liquid level of the reservoir.
19. A device of claim 1 wherein the moveable barrier is capable of being completely removed from the portion of the flow channel.
20. A device of any one of the preceding claims wherein the device is provided with one or more supports for supporting the device.
21. A device of any one of the preceding claims wherein the device is capable of controlling the liquid flow through the valve without the valve having an internal filter.
21. A device of any one of the preceding claims wherein the moveable barrier moves across the flow channel in a direction substantially perpendicular to the direction of liquid flow through the flow channel.